IC250: Lab assignment 2

1. **Matrix ADT.** HackerRank link: `https://www.hackerrank.com/ic250lab2`

   Develop an abstract data type which performs basic operations on matrices in $\mathbb{R}^{n\times m}$. The ADT must include functions for

   (a) Matrix creation, returning a matrix in $\mathbb{R}^{n\times m}$.

   (b) Matrix addition, returning a matrix in $\mathbb{R}^{n\times m}$, if dimensions are compatible.

   (c) Matrix trace (which exists only if $m = n$), returning a scalar in $\mathbb{R}$.

   (d) Matrix transpose, which operates on a matrix in $\mathbb{R}^{n\times m}$, and returns a matrix in $\mathbb{R}^{m\times n}$.

   (e) Checking for matrix equality, returning either TRUE or FALSE.

   (f) Matrix multiplication, which is possible only if dimensions are compatible.

   Once the ADT is made, have a `main()` program which operates on matrices as given in the HackerRank challenge.

   See code template on Moodle.

2. **Running time of algorithms.**

   (a) $O(n)$ algorithm to find the maximum in an array of size n.

   (b) $O(n^2)$ algorithm to find the closest pair of points in a set of n points. Each point is given as an (x, y) pair. Use the algorithm that is available in Lecture 2 of the IC250 Moodle page (slide 20.)

   What you need to do: For each of the above questions, implement the corresponding algorithms in C. Then compute the running time for various input sizes. Plot the running times on the same plot, to see the difference between an $O(n)$ algorithm and an $O(n^2)$ algorithm. Use GNUPLOT or a similar plotting program. Datasets for each question is also provided.